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Claims

[c1] 1. An apparatus for superplastic forming an article and performing a secondary operation on the article in-situ, the apparatus comprising:
a die having a cavity, the cavity having a forming surface of a predetermined shape;
a closure disposed opposite the cavity, the closure sealing the cavity;
a source of pressurized gas being supplied to the closure to force a sheet located between the cavity and closure into contact with the cavity to form a portion of the sheet into the forming surface; and
a tool movably connected to the apparatus and configured to perform a secondary operation on the sheet;
wherein the tool is advanced to perform the secondary operation while the sheet is held in compression between the cavity and closure and in contact with the forming surface.

[c2] 2. The apparatus of claim 1 further comprising an aperture adapted to receive the tool.

[c3] 3. The apparatus of claim 2 wherein the aperture is disposed in the die.

[c4] 4. The apparatus of claim 3 wherein at least part of the aperture is disposed in the cavity.

[c5] 5. The apparatus of claim 3 wherein the aperture is disposed outside the cavity.

[c6] 6. The apparatus of claim 2 wherein the aperture is disposed in the closure.

[c7] 7. The apparatus of claim 6 wherein the aperture is disposed outside a second cavity in the closure.

[c8] 8. The apparatus of claim 1 wherein the tool is disposed adjacent to a perimeter of the die.

[c9] 9. The apparatus of claim 1 wherein the tool is disposed adjacent to a perimeter of the closure.

[c10] 10. An apparatus for shaping an article made from a metal sheet and performing a secondary operation on the article in-situ, the apparatus comprising:
a first die member having a cavity defining a predetermined shape and an aperture;
a tool disposed in the aperture and slidably engageable with the article;
a source of pressurized gas; and
a second die member having an inlet for providing pressurized gas to force the metal sheet against the cavity to

shape the article;

wherein the tool is advanced to perform a secondary operation on the article after the article is shaped and before the article is removed from the cavity.

[c11] 11. The apparatus of claim 10 wherein at least part of the aperture and the tool are disposed in the cavity.

[c12] 12. The apparatus of claim 10 wherein the aperture and the tool are disposed outside the cavity.

[c13] 13. The apparatus of claim 10 wherein the secondary operation is a cutting operation and the tool is a cutting tool.

[c14] 14. The apparatus of claim 10 wherein the secondary operation is a flanging operation and the tool is a flanging tool.

[c15] 15. The apparatus of claim 10 wherein the secondary operation is a restrike operation and the tool is a restrike tool.

[c16] 16. The apparatus of claim 10 further comprising an indentation in the second die member for receiving the tool when the tool is advanced.

[c17] 17. A method for making an article with a superplastic forming apparatus, the method comprising:

securing a metal sheet between a die defining a cavity and a closure;

superplastic forming a portion of the metal sheet into a predetermined shape corresponding to the cavity in the die;

advancing a tool to engage the article and perform a secondary operation on the article when the article is secured between the die and the closure;

retracting the tool;

moving the die and the closure apart; and

removing the article from the die.

[c18] 18. The method of claim 17 wherein the step of advancing the tool to engage the article occurs while a portion of the sheet is being superplastic formed.

[c19] 19. The method of claim 17 wherein the step of advancing the tool to engage the article includes providing a pressurized gas to force the metal sheet against the tool and keeping the tool advanced until the metal sheet retains a shape imparted by the tool.

[c20] 20. The method of claim 17 wherein the step of retracting the tool occurs after the die and closure are moved apart.